

CLAIMS

What is claimed is:

1. A registration method for use in a system having a hierarchical structure
5 comprising a mobile node, at least one foreign agent, at least one gateway foreign
agent and a home agent, said method comprising the steps of:
intercepting a registration request from a mobile node to its home agent,
said registration request including a first care-of address for said mobile node;
determining whether there is an existing entry in a visitor list for said
10 mobile node;
if said entry exists, updating said entry;
if no entry exists, creating an entry in said list for the mobile node, adding
a second care-of address as an extension to said registration request, and sending
said registration request with said address extension to said home agent; and
15 sending a registration reply to said mobile node.
2. The method of Claim 1, wherein said first care-of address is the IP address
of a foreign agent, which is included in a care-of address entry of said registration
request, and said second care-of address is the IP address of a gateway foreign
20 agent.
3. The method of Claim 2, wherein said foreign agent selects said gateway
foreign agent, and relays said registration request from said mobile node to said
gateway foreign agent.
25
4. The method of Claim 1, wherein said registration reply is sent directly to
said mobile node from a gateway foreign agent if said entry exists, and said reply
is received from said home agent and relayed from the home agent to the mobile
node via a gateway foreign agent if no entry exists.
30

5. The method of Claim 4 further comprising the steps of determining whether the reply from the home agent indicates that said mobile node has successfully registered with said home agent and if so storing a lifetime value included in said registration reply, otherwise deleting the entry in said visitor list
5 for said mobile node.

6. The method of Claim 4, wherein if an entry exists, said method further comprising the steps of determining whether a lifetime for said registration request has expired and if so adding said second care-of address as an extension to
10 said registration request, and sending said registration request with said address extension to said home agent.

7. The method of Claim 1, wherein updating said entry comprises recording said first care-of address.
15

8. The method of Claim 7, wherein said entry is updated as a function of said mobile node roaming from a first foreign agent to a second foreign agent, wherein said first care of address is the IP address of said second foreign agent.

20 9. The method of Claim 1, further comprising maintaining a first and a second lifetime value.

10. The method of Claim 9, wherein said first lifetime value corresponds to the lifetime of a registration by said mobile node with its home agent, and said
25 second lifetime value corresponds to the lifetime of a registration by said mobile node with a gateway foreign agent.

11. The method of Claim 10, wherein said first lifetime value is the same as said second lifetime value.
30

12. The method of Claim 10, wherein said first lifetime value is different from said second lifetime value.

13. The method of Claim 1, wherein said first care-of address is a co-located
5 care-of address, which is included in a care-of address entry of said registration request, and said second care-of address is the IP address of a gateway foreign agent.

14. A registration method for use in a system having a hierarchical structure
10 comprising a mobile node, at least one foreign agent, at least one gateway foreign agent and a home agent, said method comprising the steps of:

receiving a registration request from a mobile node, said registration request including a first care of address in a care-of address entry of said registration request and a second care-of address added as an extension to said
15 registration request;
allowing said mobile node registration;
creating a registration entry for said mobile, which includes recording said second care-of address for use in tunneling at least one datagram to said mobile node; and
20 sending a registration reply to said mobile node.

15. The method of Claim 14, wherein said first care-of address is the IP
address of a foreign agent, and said second care-of address is the IP address of a gateway foreign agent.

25

16. The method of Claim 14, further comprising recording said first care-of address.

17. The method of Claim 16, further comprising tunneling at least one datagram to said mobile node using said second care-of address when said second care-of address is available, and tunneling said at least one datagram to said mobile node using said first care-of address when said second care-of address is
5 unavailable.

18. The method of Claim 17, further comprising removing said second care-of address from said registration entry if said second care-of address is unavailable.

10 19. The method of Claim 18, further comprising:
receiving a subsequent registration message from said mobile node including a valid care-of address added as an extension to said subsequent registration request; and
recording said valid care-of address for use in tunneling at least one
15 datagram to said mobile node.

20. The method of Claim 14, wherein said first care-of address is a co-located care-of address, and said second care-of address is the IP address of a gateway foreign agent.

21. A gateway foreign agent included in a system having a hierarchical structure comprising a mobile node, at least one foreign agent, at least one said gateway foreign agent and a home agent, said gateway foreign agent being configured for:

- 5 intercepting a registration request from a mobile node to its home agent, said registration request including a first care-of address for said mobile node;
 - determining whether there is an existing entry in a visitor list for said mobile node;
 - if said entry exists, updating said entry;
- 10 if no entry exists, creating an entry in said list for the mobile node, adding a second care-of address as an extension to said registration request, and sending said registration request with said address extension to said home agent; and
 - sending a registration reply to said mobile node.

15 22. A home agent included in a system having a hierarchical structure comprising a mobile node, at least one foreign agent, at least one gateway foreign agent and said home agent, said home agent being configured for:

- receiving a registration request from a mobile node, said registration request including a first care of address in a care-of address entry of said
- 20 registration request and a second care-of address added as an extension to said registration request;
 - allowing said mobile node registration;
 - creating a registration entry for said mobile, which includes recording said second care-of address for use in tunneling at least one datagram to said mobile
 - 25 node; and
 - sending a registration reply to said mobile node.